THE GEM & JEWELLERY EXPORT PROMOTION COUNCIL
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GEM TESTING LABORATORY

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Synthetic Pink Diamond at GTL....

Synthetic diamonds - one of the challenging stone to identify especially, when you are not equipped with various sophisticated equipment like FTIR, LRS, Diamond View, Diamond Sure, etc. These are not only challenging but also conflicting, as now it is being several months a debate is on to describe these diamonds, i.e. Nomenclature.

The producers of these diamonds are in favour of using the terms like -'lab- grown', 'created' or 'cultured' in place of synthetic, while trade associations like ICA, CIBJO or AGTA are emphasizing the usage of term 'synthetic'.

Recently, a 0.61 carats purplish pink diamond submitted for certification at Gem Testing Laboratory, Jaipur turned out to be synthetic (figure 1). The properties like luster, dispersion and specific gravity identified the material as diamond but observations under ultra violet lamp created a doubt regarding the origin. The specimen exhibited a strong orange fluorescence; reaction under shortwave was stronger than longwave. This fluorescence was also visible when stone was illuminated by fibre optic light.

Figure 1

Under desk model spectroscope, it exhibited a weak absorption in yellow orange region. When magnified, the stone was free of inclusions but growth/ colour zones were readily visible. To study the growth features in detail, stone was then observed under diffused illumination where a rectangular to square colour zone was clearly visible (figure 2). The colour of stone was also unevenly distributed where few areas appeared yellowish while some deeper pink as compared to others.

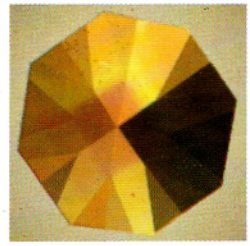

Figure 2

Diamond synthesis

Diamonds are synthesized by two processes:

i. High Pressure High Temperature (HPHT) and

ii. Chemical Vapour Deposition (CVD).

The **HPHT** technique involves the application of extreme temperature and pressure conditions on carbon where it turns to diamond; pressure of around 70 Kbars and temperature of 1300°C to 1600°C is required to grow a diamond from carbon.

HPHT growth of diamond involves a reaction cell in which carbon is fed along with catalyst like iron and nickel; temperature and pressure increases making this feed material to dissolve and nucleate on the seed crystal where diamond crystal grows.

The pressure is created in two different techniques:

- Belt Apparatus - where pressure is created by hydraulic press
- Split sphere - where pressure is created by injecting a liquid in compression barrel.

Any **HPHT** device used for the creation of large synthetic crystals has to control a great number of process parameters (more than 500) in order to achieve sizable diamonds. A slow controlled growth is essential, in order to crystallize a gem quality stone. Growth rate varies as per the manufacturer from several to very few millimeters per day; a gem-quality stone of approximately5 mm may take about three days.

CVD-a revolutionary process

As against the HPHT growth of diamonds, chemical vapour deposition (CVD) does not require a high pressure; this is exactly opposite of HPHT. Instead of

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pressuring carbon into diamond, the carbon is freed to become pure diamond. Moderate heat is applied to carbon in a chamber, where methane and hydrogen gases are also fed; a pump maintains the pressure in the chamber to about 5% of atmospheric pressure. This mixture is heated by using a microwave beam.

At temperatures of about 800°C, all atomic bonding are broken and the electrons are separated from the atomic nuclei to create plasma. The freed carbon precipitates out of plasma cloud and is deposited on a substrate.

Initially, small diamond crystals are randomly nucleated on the substrate; then, as the growth proceeds, these nuclei become larger and eventually combine to form a continuous polycrystalline film. The growth rate of this process is about 0.5 mm per day. Hydrogen gas is used to remove all traces of non-diamond (like graphite) which is formed.

The colours of synthetic diamond

Synthetic diamonds when grown are found in various colours like yellow, brown, green, gray, blue, colourless which are then treated to produce other fancy shades like red, pink, blue, etc. The most common colour for a synthetic diamond is yellow/ brown Type Ib, but the treatments like HPHT and irradiation and/ or annealing can change the basic type and hence the colour.

The pink coloured synthetic diamond is commonly produced from Type Ib (or + IaA), but the stone encountered at GTL, did not exhibited any absorption features typical for Type Ib or IaA diamonds (figure 3).

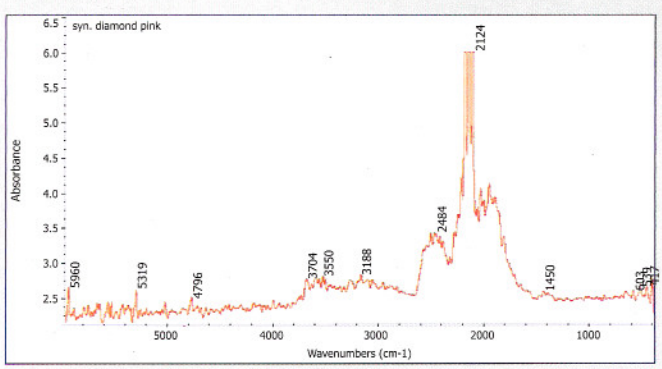

Figure 3

The identification of synthetic diamonds is a major problem in the gem industry today, as the appearance and properties of synthetic diamonds are identical. Some of the features which assist in identification of synthetic diamonds include:

- Strong green / orange fluorescence under shortwave ultraviolet.
- Growth / colour zoning following cubo- octahedral faces - commonly seen as square / rectangular / octagon in shape.
- Metallic inclusions - platelets / pinpoints of iron and nickel used as flux / catalyst

The observation of these features is very difficult and in some cases becomes almost impossible with the classical instruments or routine gemmological tests. In order to conclusively identify these synthetic diamonds, one has to switch over to sophisticated and analytical equipment like FTIR, Laser Raman Spectrophotometer, Diamond View, Diamond Sure and UV/Vis/NIR Spectrophotometer, etc. But every laboratory does not have access to all these equipment; therefore, utmost care is required when observing a diamond especially of a fancy colour.

Although, sophisticated gemmological tools are required for a conclusive identification of synthetic diamonds, but this can also be achieved with a careful examination.

GTL Results.....

Following candidates were declared successful in Gem Identification Courses

Diploma Course in Gem Identification, Batch -38

1. Kashish Sachdeva - 1st Overall
2. Smeet Zaveri - 1st Practical
3. Vineet Burman
4. Sharmistha Golyan
5. Dinesh Choudhary

Master Diploma in Gem Identification, Batch- 12

1. M. Thongminlun Haokip

Congratulations to all our students and we wish them all the very best in all their future endeavours. We hope they make a valuable contribution to the Gem & Jewellery Trade.

Stone News - Some Interesting stones at GTL....

Synthetic Star Sapphire

It has been taught and given in gemmological literature that hexagonal colour / growth zoning is one of the identifying features for a natural corundum- ruby or sapphire. But recently, at GTL we have encountered one synthetic star sapphire with such typical pattern of zoning (figure 4). Initial observations led us to believe the stone being a natural sapphire with induced star because of the typical wavy appearance of rays and silk.

Figure 4

On magnification, a hexagonal zone/ core at the top of the cabochon also became evident making our belief stronger regarding the origin of stone; this zone was surrounded by some wavy stress pattern (figure 5). In order to conclude the nature, the stone was then turned around and viewed from the back side, where we foxed by the presence of tiny whitish pinpoints (gas bubbles) arranged in curved clouds (figure 6.a). To examine these features in detail, stone was then immersed in bromoform where curved colour bands also became clear (figure 6.b). These features are characteristic for a sapphire of synthetic origin.

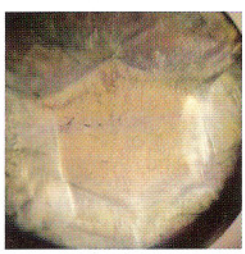

Figure 5

Figure 6.a

Figure 6.b

The stone was concluded as synthetic on the basis of curved colour bands and curved clouds of gas bubbles, but the reason for hexagonal core / zone was not clear. It may be speculated that the hexagonal zone/ core is a result of concentration of three directional silk along the crystal axes, which was visible at higher magnification using a strong fibre optic light.

This was the first time when these two features- hexagonal zoning and curved colour bands have been found together in a single stone, therefore one has to be very careful and alert while examining stones.

YAG with Unusual Colour Change Effect

Recently, an orangish pink to yellow YAG weighing 9.44 carats was identified and certified at GTL. The properties like optic character and specific gravity were consistent with those for YAG; series of lines across the spectrum were visible when viewed through desk model spectroscope.

Under magnification, it displayed a complex nature of etch channels and large gas bubbles. The interesting feature of the tested YAG was its colour change effect; the colour changed from orangish pink in daylight (figure 7.a) to orangish yellow under incandescent light (figure 7.b).

Figure 7.a

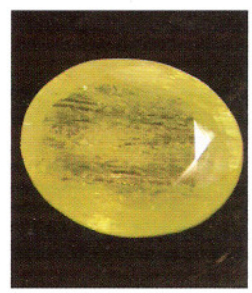

Figure 7.b

In general, colour changing stones appear pink or red under incandescent light, but in this case the effect was reverse, making this YAG unusual / interesting. The colour of the stone did not changed only when viewed in these two different types of lamps, but also when viewed at different times of a day. In morning hours, the pink component became dominant while yellow in late afternoon to evening.

Jaipur Gem Trade Loses an Invaluable Gem!

It was the morning of 28th February, when news came, which shocked everyone in the Jaipur gem industry. Shri Rashmikant Durlabhji an industry pioneer and a major contributor to the growth of Gem Testing Laboratory and the Gem & Jewellery Export Promotion Council passed away at age of 71 in Jaipur.

(1936-2007)

Rashmikantji was the second convener of GTL after his father Late Padmashri Khailshanker Durlabhji's resolute will and untiring efforts that triggered the start of GTL. As a convener (1985 2001), Rashmikantji made a significant contribution towards the development of the GTL. He was impetus behind the commencement of various courses and certification of gemstones under various categories.

Rashmikantji devoted his life to the development of Jaipur and India as the major center in the world gem trade. Towards this direction, he was nominated as the chairman of the GJEPC in the year 1983 till 1985 and again in 1995- 1996. In 1984, himself alongwith other members from 19 countries formed International Colored Stone Association (ICA), of which he was the founder Vice - President for the first six years. He also organized ICA congress at Jaipur in 2003, which is still considered as the best one held. In direction of making Jaipur more special, he initialized Jaipur Jewellery Show in 2003 and now it has become the second largest and most important show in north India.

He was a perfectionist; every small error that any one could not find out, he was capable of. In any of the events or functions he used to verify each and every arrangement well in advance in order to ensure smooth operation. He was a teacher; he was full of knowledge; if any one would sit and talk to him, one can acquire a lot of information, which is very difficult to find out in literature. Emeralds were closed to his heart and he very well understood each and every aspect of emeralds over the years of his vast experience; he really carried the title "Emerald King" received by his father. He was also passionate about horse riding and polo.

It is not only the gem and jewellery industry, which has been benefited by his efforts. He was also a social worker and if any poor who comes to him, he was always there for help. In this direction, he also opened Santokba Durlabhji Memorial Hospital, where numbers of people all over the state are being treated. The hospital is the only one of its kind in entire Rajasthan.

His devotion to GTL and the trade helped in instilling credibility in the jewellery business and made him one of the most respected and honored men in the industry. For over years, he gave selflessly to GTL and the industry. GTL acknowledges an immense respect for and deep gratitude to Shri Durlabhji, under whom it was a privilege to work and be associated with. We will miss you sir!!!

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